ONTARIO

# Ministry of the ENVIRONMENT



## Status of Industrial Water Pollution Control in Ontario as of Dec. 31, 1971

Environment Ontario

# STATUS OF

# INDUSTRIAL WATER POLLUTION CONTROL

# IN ONTARIO



as of December 31, 1971

Industrial Wastes Branch*

Water Supply and Pollution Control Division

MINISTRY OF THE ENVIRONMENT

June 1972

*NOTE: *The OWRC and the Division of Industrial Wastes are referred to repeatedly in this report as it describes the status of pollution control at the end of 1971. Subsequently, the OWRC was integrated into the Ministry of the Environment in April 1972.*

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## INTRODUCTION

This report is the fourth of a series relating to the status of industrial water pollution in Ontario.

The first two reports dealt primarily with the documentation of individual industries together with a brief notation of the plant processes involved, the general types of problems to be expected from wastes arising from specific industrial operations, the degree of treatment, if any, at each plant and the acceptability of the effluent objectives.

In the third report in 1968, an attempt was made to quantify, for the first time, data on many facets of the pollution control program, to indicate areas of concern and to suggest possible mechanisms to deal with these problem areas.

This report follows the format of the 1968 report with a summary of the status of industrial pollution control in Ontario and a review of progress achieved in those areas of concern expressed at that time. Again, possible broad approaches are suggested to improve the overall program of achieving better wastewater management practices by industry.

However, certain limitations of the data contained in this report should be noted from the outset in order to properly interpret results and information in this document.

(1) Reliability of Data

The data presented in this report are influenced by the nature and intensity of existing effluent monitoring programs which are established on the basis of priorities, and therefore somewhat limited in certain areas. For example, steel mills, petroleum refining and petrochemical plants are indicated as the major sources of phenolic materials. However, this might be significantly altered if measurements of phenolics were made at pulp and paper mills,

even though the phenolic materials are different, being of natural origin in the form of lignins and their complex derivatives. In addition, although all major sources of specific contaminants listed in this report have been surveyed, nevertheless, the gross magnitude of some contaminants such as oily materials (ether solubles) and metals might change appreciably, if all industrial sources of such materials were monitored. The same holds true for nutrients in that not enough data on low-level concentration sources are available at this time to assess the total industrial input of nitrogen and phosphorus to surface waters in Ontario.

(2) Restrictiveness of Data

Only data relating to direct industrial discharges to surface waters in Ontario have been given in-depth analysis in this report. As a result, the figures in this status report do not truly reflect the total industrial water pollution picture in the Province, for although much work is done by staff on problems caused by industrial discharges to municipal sewer systems, an overall assessment of these wastes and their subsequent effects on municipal discharges to surface waters is not included. Also, data dealing with industrial discharges to land disposal systems are only given token consideration even though adverse effects can be experienced on surface and ground water quality.

Hopefully, in the future, the data limitations in this report will be rectified by more comprehensive monitoring programs on the part of industries and the Ministry of the Environment, and the implementation of a suitable automated data processing system. To date, data processing has been totally on a manual basis, hence the reasons for the limitations mentioned above.

## SUMMARY


Approximately 500 Industries Discharging to Watercourses

(1) At the end of 1971, 497 industrial plants were discharging aqueous effluents directly to watercourses. This figure is about 22 percent lower than the total of 627 industries listed at the end of 1968. The difference is due largely to plant closures and also to industries either developing non-effluent systems or re-directing their wastes away from watercourses to municipal sewage systems for treatment. Industries with non-effluent systems totalled 484 and staff have visited over 700 industries which discharge wastes to municipal sewer systems.

Sixty Percent of Industries Meeting Effluent Requirements

(2) Approximately 60 percent of the industrial plants which discharge effluents directly to receiving watercourses have acceptable means of waste control and generally meet current OWRC effluent requirements. (Table I)

Waste Loadings Reduced in the Period 1968-1971

(3) Substantial reductions in industrial waste loadings to watercourses were achieved during the three-year period 1969-1971. In comparing data compiled at the end of 1968 and 1971, $BOD_5$ loadings were found to be reduced by 30 percent; suspended solids by 74 percent; oils, greases and fats by 70 percent; and metals such as iron, zinc, chromium, lead and copper by 62 percent. (Table II)

High Level of Organic Wastes Discharged by Industries

(4) At the end of 1971, organic loadings to watercourses from all industries in Ontario, measured in terms of 5-day biochemical oxygen demand ($BOD_5$), were approximately equivalent to sanitary sewage from 12 million persons.

While the comparison is not rigidly correct, nevertheless, the relative magnitude of $BOD_5$ discharged by industry in terms of a population equivalent (compare with Ontario's population of just over 7 million) is interesting. (Tables III and IV)

Resource-based Industries Contribute Significantly to Waste Loadings

(5) In terms of total waste loadings to rivers and lakes from all industries, the pulp and paper industry discharges the majority of $BOD_5$ (88 percent) and suspended solids (69 percent). The steel industry is responsible for 79 percent of oily discharges and 73 percent of metal losses in this instance, mostly iron. The mining industry discharges 20 percent of all other metals such as zinc, copper and lead. (Figures 1 and 2)

Pulp and Paper - A Major Pollution Problem

(6) Only 3 plants in the pulp and paper industry of a total of 32 which discharge wastes directly to watercourses meet OWRC effluent requirements. The lack of adequate capital funds for construction of waste treatment facilities has been cited by the industry as the major obstacle to faster progress, and as a result, water pollution from this industry continues to be a major problem.

Areas of Concern Still Exist

(7) Many difficult technical problems and areas of concern exist which require further research, investigation and proper planning and policy development to arrive at suitable solutions. Such areas of concern include thermal pollution, polychlorinated biphenyls, tainting and toxic substances in kraft mill effluents, siting of

major industrial developments with respect to environmental impact, financial incentives to industry for pollution control facilities, the establishment of water quality standards and the implementation of plans for drainage basin management.

Problems Evident in the Control of Industrial Discharges to Municipal Sewer Systems

(8) The discharge of industrial wastes to municipal sewerage systems for treatment is causing a number of technical and complex administrative problems. Variable sewer-use by-law limits on specific contaminants and inconsistent enforcement of these by-laws in different municipalities are two areas of concern. In addition, differing surcharge levies for overstrength wastes and the legality of special agreements between industries and municipalities on such matters require further attention. (Table V)

Pollution Abatement Expenditures by Industry for Period 1957-1971 Total Approximately $214 million

(9) Five hundred and ninety-three (593) certificates of approval for industrial waste treatment facilities have been issued by the OWRC for an estimated total cost of approximately $116 million for the period July 1965 to December 1971. Prior to 1965 and the certification program of the OWRC, industries claimed that $98 million were spent on waste abatement programs during the period 1957-1965, 1957 being the first year of existence of the OWRC. As a result, it would appear that a minimum of $214 million have been spent by the industrial sector on pollution abatement procedures during the 15-year period 1957-1971, an average of just over $14 million per annum. It must be

noted that the term 'minimum expenditure' is used above, for the costs incurred by industry in constructing pretreatment works for high-strength wastes prior to discharge to municipal sewer systems and in addition, those costs for jointly-shared municipal-industrial treatment works have not been included. (Table VI, Figures 3 and 4)

Rate of Spending for Pollution Control has Increased in 1970-1971

(10) Although the average annual expenditure over the past 15 years has been about $15 million, the two-year total for 1970-1971 of approved costs for treatment works was $68 million which shows an increasing rate of expenditure by industry. Projected estimates for 1972 are $50 million.

Despite Increased Rate of Spending, Existing Economic Climate Slowing Down Many Important Pollution Control Programs

(11) Current economic conditions which prevail in Ontario are seriously slowing down the rate at which industrial pollution of the aquatic environment is being brought under control. The real possibility of plant closures coupled with the attendant consequences of unemployment and other social problems, particularly in those communities which are entirely dependent on one major industry, is a frequent argument put forward by many companies for not implementing or only partially completing satisfactory pollution control programs at this time.

Abatement Costs Estimated at $300 million to Clean Up Existing Pollution

(12) Estimated costs to abate existing industrial water pollution in Ontario using current yardsticks are just over $300 million (1971 dollars). Of this sum, about $150 million are required in the Lower Great Lakes drainage basin. (Table VII; Figure 5)

Legal Activities

(13) There were 40 prosecutions of industry and 26 Orders issued in the three-year period 1969-1971. Altogether, 56 companies have been prosecuted and 32 Orders issued since 1965, when the industrial pollution control program was first recognized as a high priority issue in the overall water pollution control program of the OWRC. Of a total of 95 charges, there have been 73 convictions for fines of $27,405. This is equivalent to an average fine of $375 per conviction. (Table VIII, Figure 6 )

Spills of Chemicals Constitute Significant Pollution Load

(14) Spills and unusual discharges of hazardous materials, such as petroleum hydrocarbons and other chemicals, to watercourses cause serious damage to the aquatic environment and are a significant contributing factor to the overall pollution load in Ontario. In 1970, legislation was passed requiring unusual discharges of materials to be reported to the OWRC and in 1971, 285 such incidents were recorded. Of these, 19 were considered of a most serious nature involving chemicals and petroleum products. Only 49 (17 percent) of all spills were classed as true accidents such as derailments and tank truck upsets. Reasons for the unusual discharges of materials included negligence, faulty maintenance, lack of operator training and equipment failures. (Table IX)

Contingency Plans in Existence to Deal with Unusual Discharges

(15) An Interim Province of Ontario Contingency Plan has been developed to deal with major spills of oil and other hazardous materials, and it is anticipated that the plan will be finalized within one year. The Ontario Contingency Plan is compatible with the Federal and International Contingency Plans in the Great Lakes basin, and with local co-operative contingency plans throughout the remainder of the Province. A spill response centre, called the Ontario Operations Centre, has been established within the Ministry of the Environment to deal with spill problems on a 24-hour basis.

TABLE I

DEGREE OF COMPLIANCE BY INDUSTRIAL GROUPS WITH OWRC EFFLUENT REQUIREMENTS AS OF DECEMBER 1971

| Industry Group | Number of Plants Discharging directly to Watercourses | Number of Plants with Acceptable Discharge | Percentage of Plants with Acceptable Discharge |
|---|---|---|---|
| Basic Iron and Steel | 5 | 1 | 20.0 |
| Chemicals | 44 | 22 | 50.0 |
| Food Processing | 103 | 48 | 46.6 |
| Metal Plating and Finishing | 105 | 86 | 81.9 |
| Mining and Metallurgical | 89 | 69 | 77.6 |
| Miscellaneous Manufacturing | 68 | 46 | 67.7 |
| Petroleum and Petrochemical | 20 | 9 | 45.0 |
| Pulp and Paper | 32 | 3 | 9.4 |
| Service | 22 | 18 | 81.8 |
| Tanning and Rendering | 3 | 1 | 33.3 |
| Textiles | 6 | 2 | 33.3 |
| Total | 497 | 305 | 61.4 |

(a) Numbers of Industries with Non-Effluent Systems: 484

(b) Industries Discharging to Municipal Sewerage Systems: 720

The figures for (a) and (b) are shown because inspection of waste disposal operations and investigations into pollution problems caused by these industries comprise a very significant workload for staff.

TABLE II

INDUSTRIAL WASTE FLOWS AND CONTAMINANT LOADINGS TO NATURAL WATERCOURSES

| | 1968 | 1971 | % Change |
|---|---|---|---|
| **Waste Flows:** $10^6$ gals/day | | | |
| Industrial | 2,350 | 2,110 | -10 |
| Thermal Electric Power Generation (cooling water) | 2,600 | 3,100 | +20 |
| Total | 4,950 | 5,210 | |
| **Waste Loadings:** $10^3$ lbs/day | | | |
| $BOD_5$ | 3,400 | 2,360 | -30 |
| Suspended Solids | 5,200 | 1,370 | -74 |
| Total Metals | 108 | 41 | -62 |
| Oils, fats, greases (ether solubles) | 106 | 34 | -70 |
| Chlorides | 7,100 | 7,600 | + 7 |
| Nitrogen | 150 | 135 | -10 |
| Phosphorus | 16 | 2 | -90 |
| Dissolved Solids | > 15,000 | >12,000 | |
| Phenolics | 10 | 3 | -70 |
| Sulphates | * | 341 | |

* No figures for 1968

Major reasons for % Changes between 1968 and 1971

Suspended Solids

(i) Installation of 7 clarifiers and 4 sedimentation lagoons by the pulp and paper industry.

(ii) New tailings impoundment area built by Kerr-Addison Mine, thus eliminating 1 million pounds per day of untreated tailings to Larder Lake.

Total Metals

(i) Reduced losses of iron and iron oxides by steel companies.

(ii) Better treatment procedures at mining operations.

Oils

(i) Oil removal facilities installed at the steel mills.

Phosphorus

(i) Installation of recycle and treatment system at Electric Reduction Company at Port Maitland, which was single largest industrial source of phosphorus.

Cooling Water for Thermal Power Generation

(i) Start-up of first 500 megawatt nuclear reactor unit at Pickering by Ontario Hydro.

TABLE III

DISCHARGES TO SURFACE WATERS IN ONTARIO BY MAJOR INDUSTRIAL GROUPS

Waste Loadings: $10^3$ lbs/day

| Industry Group | Waste Flow mgd | $BOD_5$ | Suspended Solids | Ether Solubles | Total Metals | Other Contaminants |
|---|---|---|---|---|---|---|
| Basic Iron and Steel | 656 | 97.0 | 171.1 | 27.0 | 29.6 | Sulphates - 29.0<br>Dissolved Solids - 334.1<br>Cyanide - 8.75<br>Iron - 29.5<br>Nitrogen - 84.2<br>Phenolics - 2.1<br>Chlorides - 78.0 |
| Chemicals | 391 | 48.7 | 89.8 | N/M* | 1.2 | Chlorides - 7,460.<br>Sulphates - 55.1<br>Nitrogen - 47.8<br>COD - 161.4<br>Zinc - 0.9 |
| Food Processing | 33 | 94.8 | 47.1 | 0.1 | | |
| Metal Plating and Finishing | 78 | - | 42.8 | 1.9 | 1.6 | |
| Mining and Metallurgical | 137 | - | 49.1 | - | 8.1 | Sulphates - 256.8<br>Arsenic - 0.1<br>Cyanide - 1.25 |
| Miscellaneous Manufacturing | 15.5 | 3.1 | 9.2 | N/M | N/M | |
| Petroleum and Petrochemical | 339 | 38.0 | 11.2 | 5.4 | N/M | Phenolics - 0.16<br>COD - 163.0 |
| Pulp and Paper | 462 | 2,077 | 947.5 | - | 0.3 | Dissolved solids -2,800 |
| Service | 3,100 | - | 5.2 | N/M | | |
| Tanning and Rendering | 0.9 | 2.9 | 1.5 | N/M | N/M | |
| Textiles | 1.6 | 0.5 | 0.2 | N/M | N/M | |
| Total Industrial | 5,210 | 2,362 | 1,374 | 34.4 | 40.8 | $10^3$ lbs/day<br>Phenolics 3<br>Nitrogen 134<br>Chlorides 7,600<br>COD 324<br>Cyanide 10<br>Dissolved solids (including chlorides 12,000 |
| Rounded off to : | 5,210 | 2,360 | 1,370 | 34 | 41 | |

**********

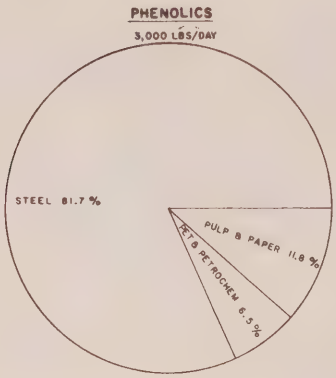
| | | | |
|---|---|---|---|
| Total Municipal (estimated) | 700 | 150 | 150 |

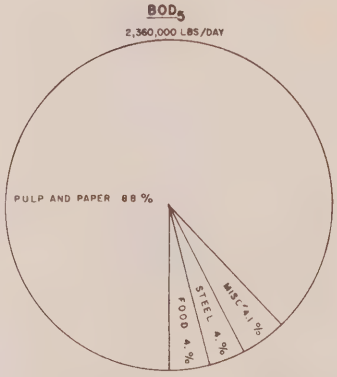
Total Agricultural Water Usage: 100 mgd

* not measured

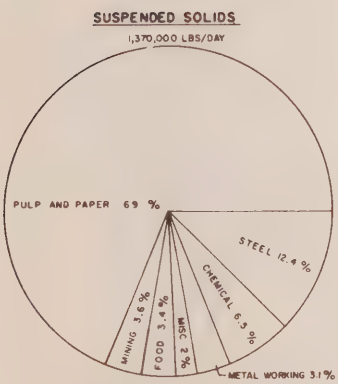
# FIGURE 1
## RELATIVE CONTRIBUTION OF CONTAMINANT LOADINGS BY INDUSTRIAL GROUPS


TOTAL MUNICIPAL: 700,000,000 GAL./DAY (ESTIMATED)

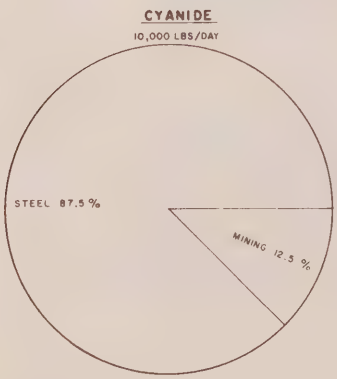


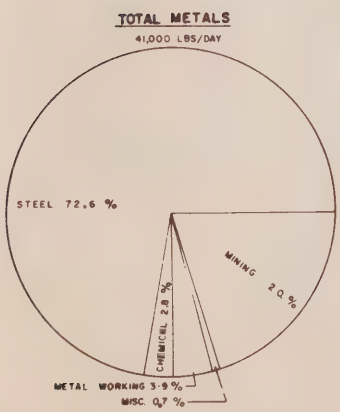

TOTAL MUNICIPAL: 150,000 LBS/DAY (ESTIMATED)




TOTAL MUNICIPAL: 150,000 LBS/DAY (ESTIMATED)









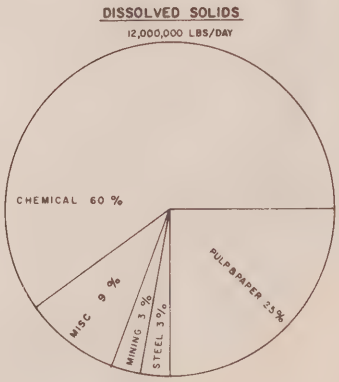


TABLE IV

INDUSTRIAL WASTE FLOWS AND CONTAMINANT LOADINGS TO MAJOR DRAINAGE BASINS

| Drainage Basin | Flow $10^6$ gal/day | Waste Loadings: $10^3$ lbs/day | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $BOD_5$ | Suspended Solids | Ether Solubles | Chlorides | Sulphates | Total Metals | Phosphates | Nitrogen |
| Hudson Bay/ Artic | 166 | 616.4 | 398.3 | | | 14.0 | 1.07 | | |
| Lake Superior | 242 | 637.3 | 234.6 | | | 36.2 | 1.07 | | |
| Lake Huron** | 500 | 229.5 | 149.5 | 5.96 | 74.7 | 223.3 | 10.6 | 0.11 | 44.4 |
| St.Clair River | 1,265 | 35.0* | 58.3 | 4.4 | 1,288 | | 0.1 | 0.09 | 2.0 |
| Lake St. Clair | 18 | 3.0 | 16.2 | 0.21 | 12.0 | | 0.05 | | |
| Detroit River | 71 | 1.7 | 70.8 | 0.37 | 6,203 | | | | |
| Lake Erie | 36 | 7.0 | 8.0 | | | | 0.7 | 0.42 | |
| Niagara River | 25 | 0.5 | 12.9 | 0.31 | | | 2.05 | | 27.1 |
| Lake Ontario | 2,733 | 372.4 | 258.4 | 23.1 | 6.0 | 24.2 | 24.2 | 1.2 | 40.5 |
| St. Lawrence River | 109 | 203.0 | 138.0 | | | 43.1 | 0.9 | 0.02 | 20.5 |
| Ottawa River | 41 | 255.8 | 28.8 | | | | | 0.03 | |
| Total | 5,210 | 2,360 | 1,370 | 34 | 7,600 | 341 | 41 | 2 | 135 |

* Because of the complex nature of the wastes discharges to the St. Clair River from the chemical industries, few measurements of $BOD_5$ are made. However, a total of approximately 462,000 lbs/day of COD is discharged, which gives a better assessment of the oxygen demand characteristics of the various wastes.

** includes St. Mary's River

FIGURE 2

RELATIVE CONTRIBUTION OF LOADINGS FROM INDUSTRY TO MAJOR DRAINAGE BASINS

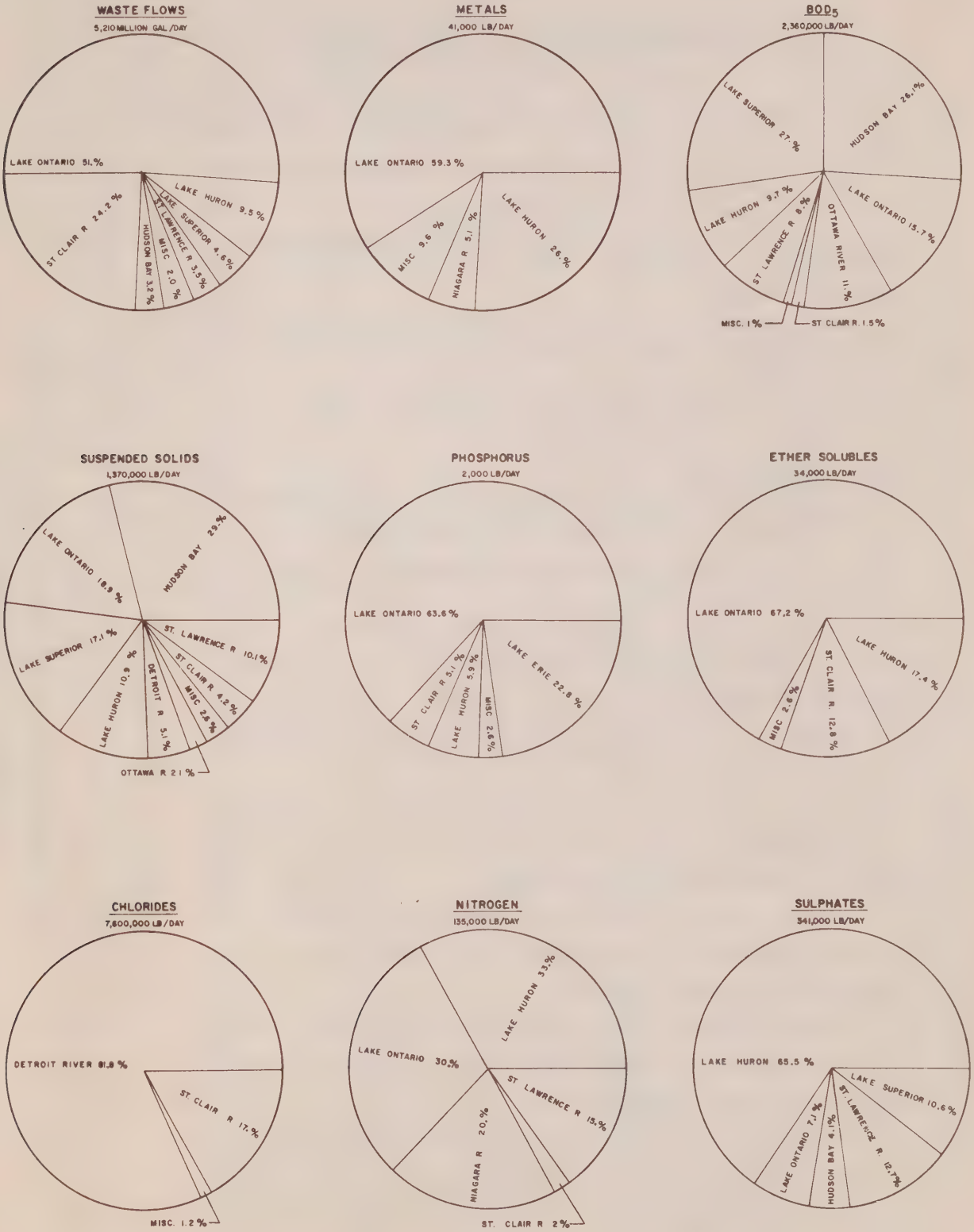


TABLE V

MUNICIPAL CONTROL OF INDUSTRIAL WASTES
TO SANITARY SEWER SYSTEMS

Two basic requisites are needed for satisfactory municipal control of industrial wastes to sanitary sewer systems:

(1) enactment of an appropriate sewer-use by-law

(2) a by-law enforcement program

| | |
|---|---|
| Municipalities in Ontario with Sewage Treatment Works | 265 |
| **Sewer-Use By-Laws** | |
| Municipalities that should enact sewer-use by-law (industrial wastes being discharged to sewer systems) | 194 |
| Municipalities that have enacted some form of sewer-use by-law | 136 |
| **By-Law Enforcement** | |
| Municipalities that have been requested by OWRC to implement a by-law enforcement program | 66 |
| Municipalities that have implemented a by-law enforcement program | 43 |
| Municipalities that are in the process of implementing an enforcement program | 21 |
| **Sampling Schedule** | |
| Municipalities with a regular sampling schedule to determine conformance of discharges with the by-law limits | 11 |
| Municipalities with an "as is required" sampling schedule | 18 |
| **Sampling and Analytical Equipment** | |
| Municipalities with waste sampling equipment | 24 |
| Municipalities with analytical capability | 12 |
| **By-Law Enforcement Staff** | |
| Municipalities with full-time enforcement staff | 2 |
| Municipalities with part-time enforcement staff | 45 |
| **Sewer-Use Control Program** | |
| Municipalities with a satisfactory sewer-use control program | 71 |
| Municipalities with an unsatisfactory sewer-use control program | 73 |

TABLE VI

ESTIMATED CAPITAL EXPENDITURES

FOR INDUSTRIAL POLLUTION ABATEMENT FACILITIES

1957 - 1971

| Industry Classification | $10^3$ 1957-65 | $10^3$ 1965-71 | % of Dollar Value 1965-71* | Number of Certificates 1965-71 | $10^3$ 1957-71 |
|---|---|---|---|---|---|
| Basic Iron and Steel | 5,390 | 25,710 | 22.2 | 28 | 31,100 |
| Chemicals | 8,563 | 10,739 | 9.3 | 115 | 19,302 |
| Food Processing | 1,018 | 5,056 | 4.4 | 96 | 6,074 |
| Metal Plating and Finishing | 398 | 9,671 | 8.4 | 61 | 10,069 |
| Mining and Metallurgical | 21,941 | 19,766 | 17.0 | 90 | 41,707 |
| Miscellaneous Manufacturing | 3,433 | 3,748 | 3.2 | 73 | 7,181 |
| Petroleum and Petrochemical | 22,561 | 6,676 | 5.8 | 45 | 29,237 |
| Pulp and Paper | 33,952 | 21,047 | 18.1 | 43 | 54,999 |
| Service | 152 | 12,914 | 11.1 | 33 | 13,066 |
| Tanning & Rendering | 600 | 309 | 0.3 | 6 | 909 |
| Textiles | 52 | 208 | 0.2 | 3 | 260 |
| | 98,060** | 115,844 | 100.0 | 593 | 213,904 |

* Percentage based on estimated costs for treatment works approved by OWRC to be spent by industry: July 1965 - December 1971.

** This total is based on figures presented by industry as having been spent prior to implementation of the approval program by OWRC.

FIGURE 3

CERTIFICATES OF APPROVAL — ESTIMATED COSTS OF TREATMENT WORKS: JULY 1965 TO DECEMBER 1971

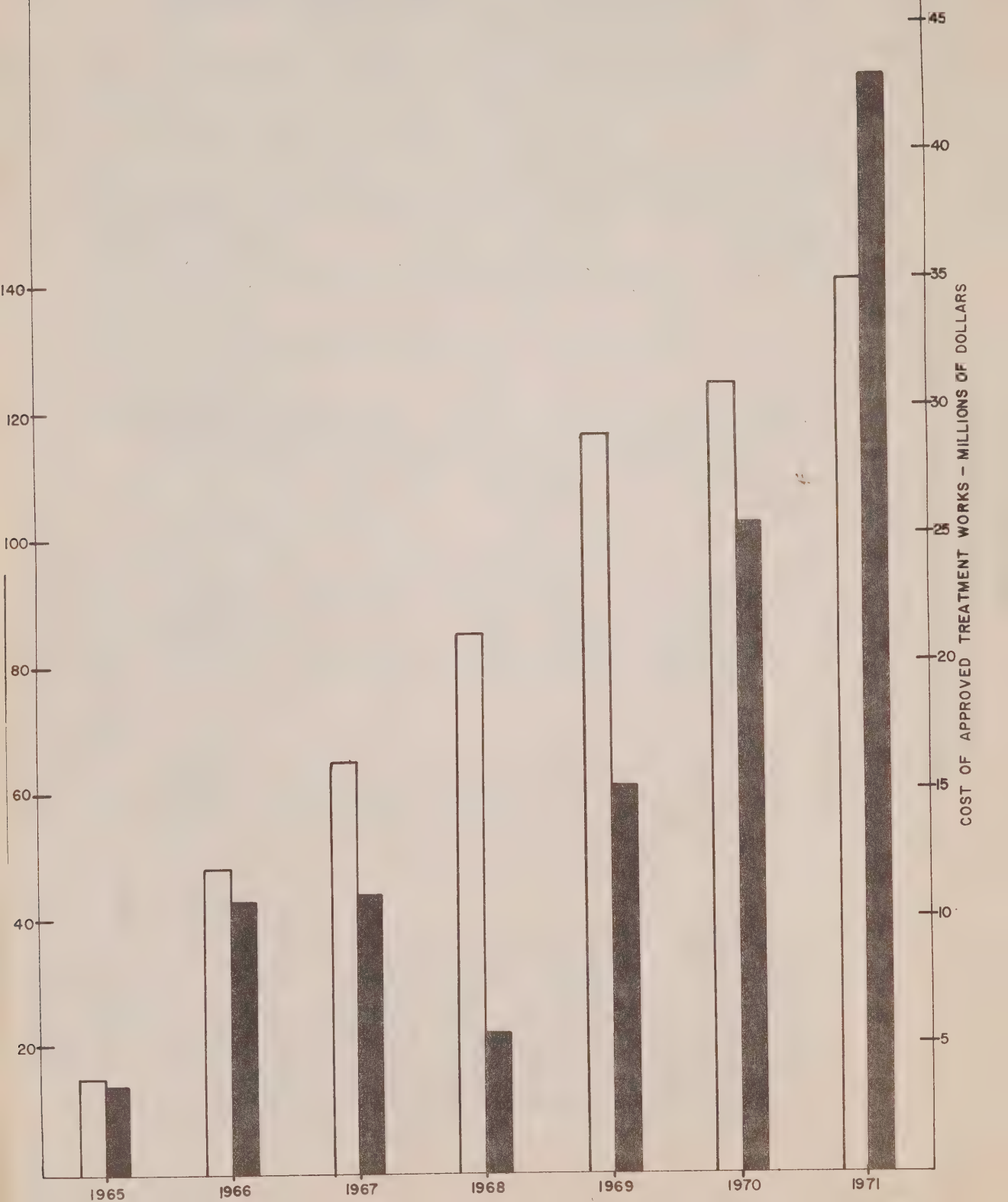
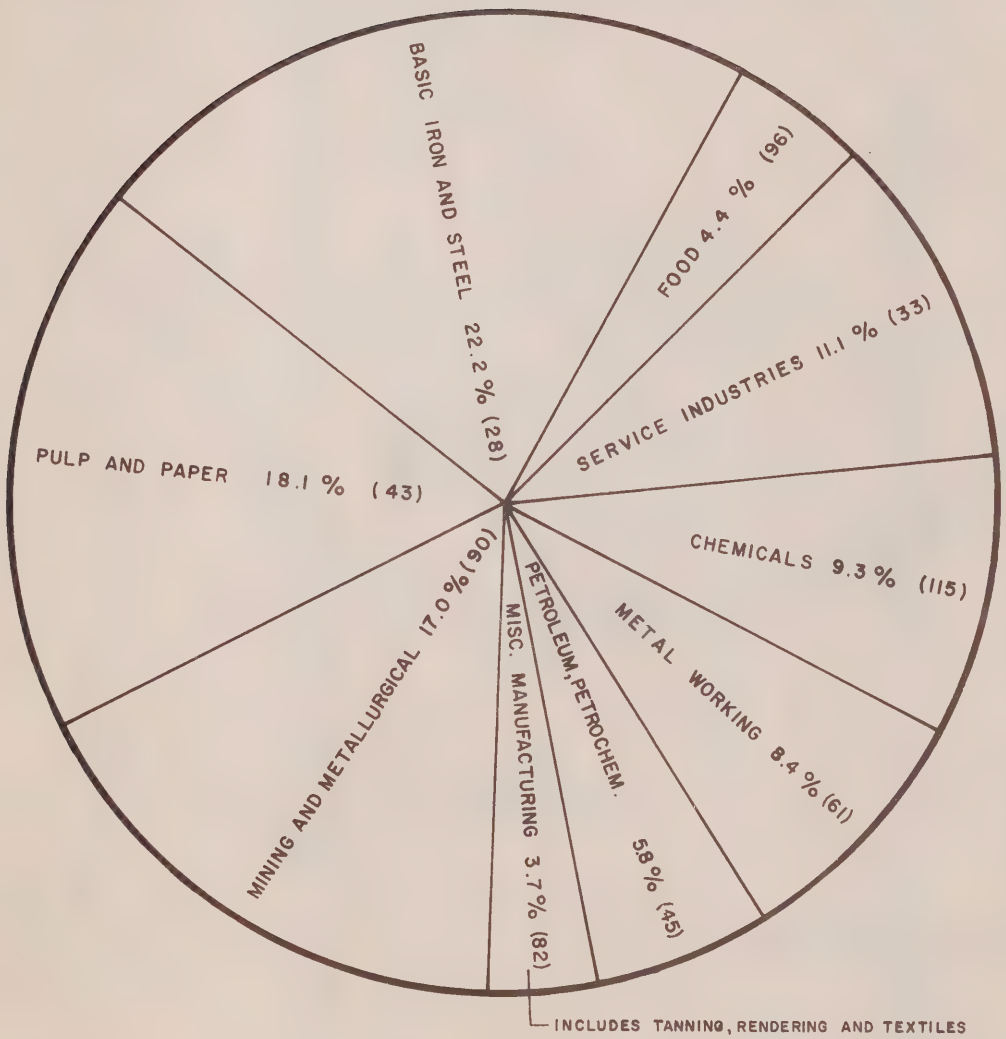


FIGURE 4

RELATIVE DISTRIBUTION OF ESTIMATED EXPENDITURES
APPROVED BY OWRC 1965 — 1971




(96) — INDICATES NUMBER OF CERTIFICATES APPROVED.

TABLE VII

PROJECTED COST ESTIMATES TO EFFECT POLLUTION CONTROL CONSISTENT WITH CURRENT OWRC OBJECTIVES (1971) - MILLIONS OF DOLLARS

| Drainage Basin | Pulp and Paper | Mining and Metallurgical | Basic Iron and Steel | Petroleum and Petrochemical | Chemicals | Food Processing | Metal Plating & Finishing | Miscellaneous* Manufacturing | Service | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Hudson Bay/ Artic | 32.8 | 0.8 | | | | | | | | 33.6 |
| Lake Superior | 44.0 | 2.7 | | | | 2.2 | | | | 48.9 |
| St. Mary's River/Lake Huron | 9.5 | 52.0 | 2.6 | | 0.05 | 0.1 | 0.1 | 0.05 | 0.2 | 64.6 |
| St. Clair River/ Lake St. Clair/ Detroit River | | 0.1 | | 29.0 | 51.2 | 0.24 | 1.0 | 0.14 | | 81.7 |
| Lake Erie | | 1.2 | | | 2.0 | 0.25 | 0.05 | 0.16 | | 3.7 |
| Niagara River | | | 4.2 | | 4.05 | | 0.05 | | | 8.3 |
| Lake Ontario | 10.25 | 0.1 | 35.05 | | 0.3 | 1.41 | 2.2 | 0.61 | 0.1 | 50.0 |
| St. Lawrence River | 4.0 | | | | 1.94 | 0.41 | 0.04 | | | 6.4 |
| Ottawa River | 8.25 | | | 0.13 | | 0.18 | 0.03 | 0.34 | | 8.9 |
| TOTAL | 108.8 | 56.9 | 41.85 | 29.13 | 59.54 | 4.61 | 3.47 | 1.3 | 0.3 | 306.1 |

* includes tanning, rendering and textiles in this table

NOTE: This table does not include cost of facilities under construction and/or formally approved at the end of 1971

FIG. 5

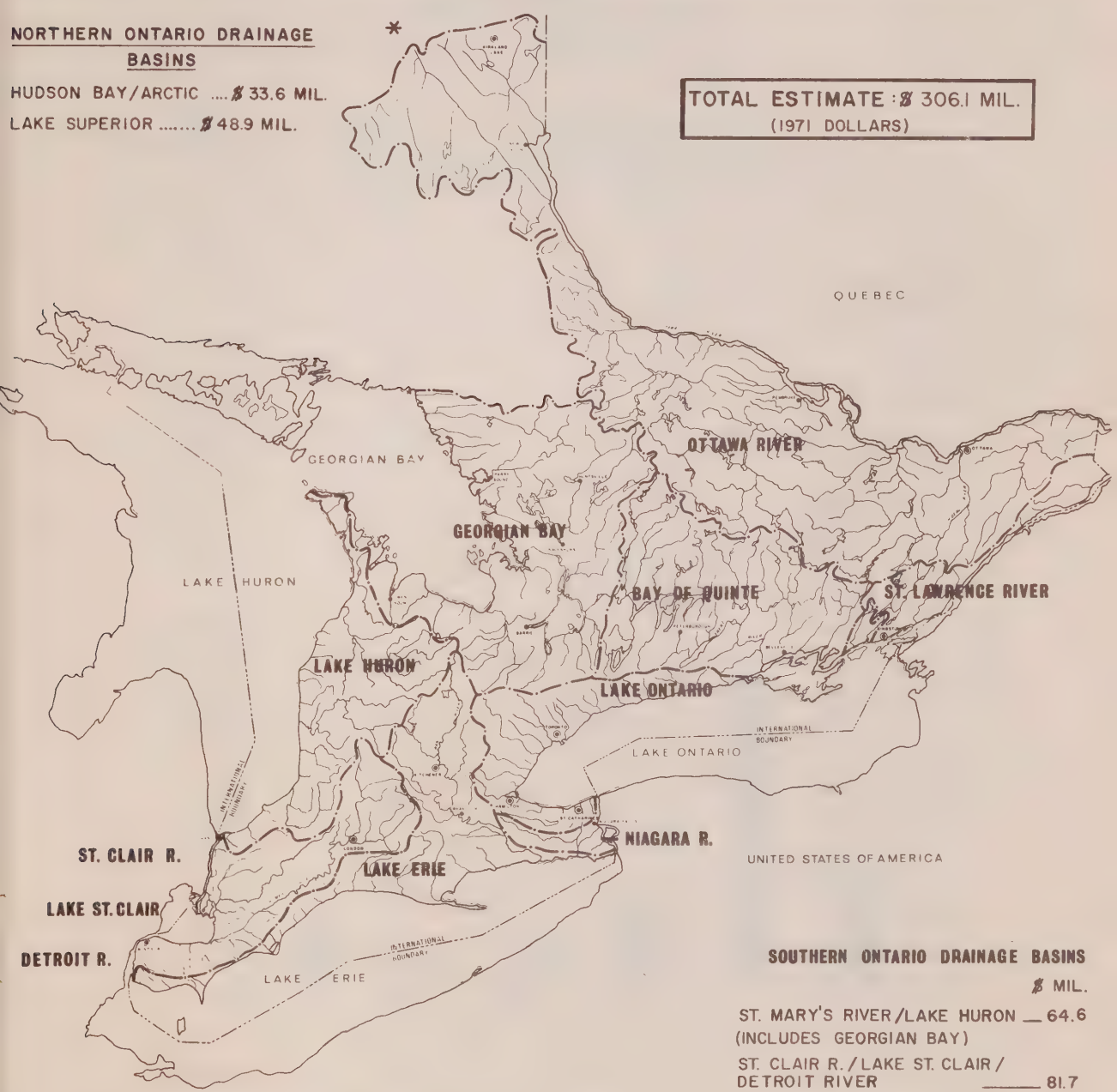
## PROJECTED COST ESTIMATES ON DRAINAGE BASIN BASIS TO ABATE EXISTING INDUSTRIAL POLLUTION

**NORTHERN ONTARIO DRAINAGE BASINS**

HUDSON BAY/ARCTIC .... $ 33.6 MIL.

LAKE SUPERIOR ..... $ 48.9 MIL.

**TOTAL ESTIMATE : $ 306.1 MIL.**
(1971 DOLLARS)




**SOUTHERN ONTARIO DRAINAGE BASINS**

| | $ MIL. |
|---|---|
| ST. MARY'S RIVER/LAKE HURON (INCLUDES GEORGIAN BAY) | 64.6 |
| ST. CLAIR R./LAKE ST. CLAIR/ DETROIT RIVER | 81.7 |
| LAKE ERIE | 3.7 |
| NIAGARA RIVER | 8.3 |
| LAKE ONTARIO (INCLUDES BAY OF QUINTE) | 50.0 |
| ST. LAWRENCE RIVER | 6.4 |
| OTTAWA RIVER | 8.9 |

* - NORTHERN ONTARIO DRAINAGE BASIN NOT SHOWN ON THIS MAP.

## TABLE VIII

SUMMARY OF LEGAL ACTIVITIES
BY OWRC
AGAINST INDUSTRIES*: 1965-1971

I

| Year | Companies Prosecuted | Orders | Public Hearings |
|---|---|---|---|
| 1965 | 0 | 0 | 0 |
| 1966 | 1 | 3 | 1 |
| 1967 | 10 | 1 | 1 |
| 1968 | 5 | 2 | 7 |
| 1969 | 2 | 4 | 6 |
| 1970 | 24 | 16 | 3 |
| 1971 | 14 | 6 | 4 |
| TOTAL | 56 | 32 | 22 |
| TOTAL CHARGES | 95 | | |
| TOTAL CONVICTIONS | 73 | | |
| TOTAL FINES | $27,405.00 | | |
| AVERAGE FINE/ CONVICTION | $ 375.41 | | |

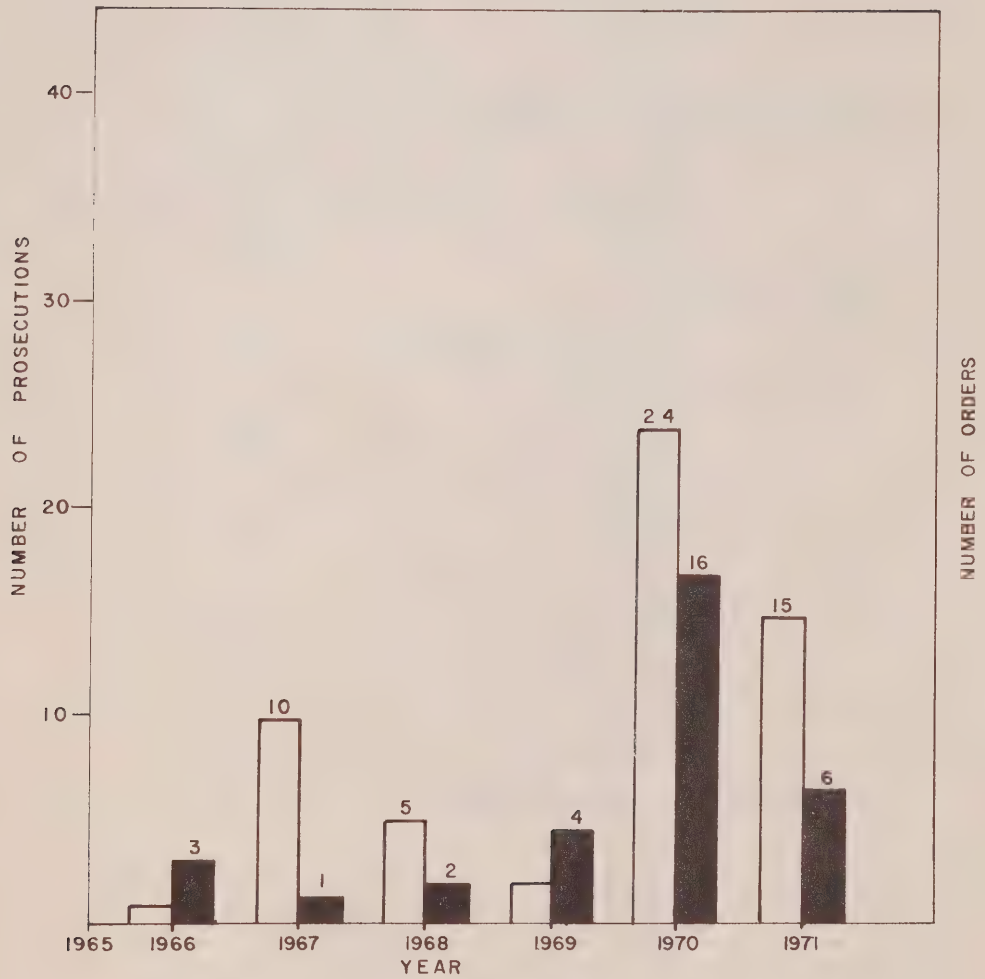
II

| Industrial Classes | Companies Prosecuted | Orders | Fines in Dollars ($) |
|---|---|---|---|
| Basic Iron and Steel | - | - | - |
| Chemicals | 3 | 7 | 1,800 |
| Food Processing | 18 | 1 | 5,450 |
| Metal Plating and Finishing | 11 | 8 | 4,105 |
| Mining & Metallurgical | 2 | 4 | 1,900 |
| Petroleum and Petrochemical | - | - | - |
| Tanning & Rendering | 1 | - | 50 |
| Pulp and Paper | 8 | 12 | 9,250 |
| Service | 13 | - | 4,900 |
| Total (1965-1971) | 56 | 32 | $27,405 |

* Does not include legal action against industry taken by private citizens or public groups.

FIGURE 6

PROSECUTION AND ORDERS: 1965 TO 1971



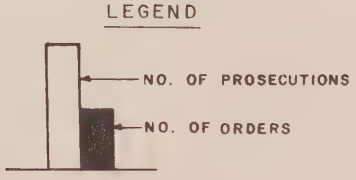



TABLE IX

UNUSUAL DISCHARGES OF MATERIALS RECORDED IN 1971

| | | |
|---|---|---|
| Total Number of Spills: | 285 | |
| Gravity of Incident | | |
| Minor | 182 | (64%) |
| Moderate | 84 | (29%) |
| Serious | 19 | ( 7%) |
| Nature of Material Lost | | |
| Oils | 167 | (59%) |
| Chemicals | 67 | (23%) |
| Others | 51 | (18%) |
| Causes of Spill | | |
| Equipment Failure | 113 | (39%) |
| Negligence and Carelessness | 90 | (31%) |
| True Accident | 49 | (17%) |
| Faulty Maintenance | 7 | ( 2%) |
| Lack of Training | 4 | (1.5%) |
| Vandalism | 3 | ( 1%) |
| Unknown or Undetermined | 21 | ( 7%) |
| Breakdown of Serious Spills | | |
| Oils | 6 | |
| Chemicals | 11 | |
| Other | 2 | |
| | 19 | |

AREAS OF CONCERN

Fourteen areas of concern were identified in the 1968 Status Report on Industrial Pollution Control in Ontario and these are reproduced in this report for ready reference by the reader to indicate the progress made over the past three years. Since 1968, a number of new issues have arisen such as the mercury problem, the presence of polychlorinated biphenyls in appreciable quantities in several species of fish in the Great Lakes system and the introduction to the aquatic environment of many types of specialty chemicals through losses from manufacturing processes.

## (i) Acid Mine Drainage

1968

Natural production of acids in mine and milling wastes is a serious problem in Sudbury and other areas such as Elliot Lake and Manitouwadge where iron sulphide-bearing ores are mined and milled for the extraction of base metal values. Acid mine drainage results in depression of pH values, and is usually accompanied by metals such as copper, zinc, nickel and iron going into solution. Acid formation occurs not only in mine water, but of more importance, in tailings impoundment areas (both active and abandoned) and in downstream rivers and lakes. The chemical reactions, including the rates of oxidation, are not fully understood and research is being carried out on this subject.

1971

The phenomenon of acidic conditions which develop in tailings areas and downstream waters due to base metal operations involving high sulphide ores is now well known. The Serpent River watershed is a classic example of this type of pollution caused by inadequate waste treatment practices by the uranium mining industry over a decade ago. The acid mine drainage problem was well documented late in the year by staff in a comprehensive report entitled "The Problem of Acid Mine Drainage in the Province of Ontario" and is now available to the mining industry and to the public. In general, by the end of 1971, acid mine drainage problems in the Province were slowly coming under control and substantial acid abatement programs in critical areas had been initiated.

During the last couple of years, staff found it necessary to actively encourage the mining industry to reduce the amounts of water required for processing ores. The beneficial effect of such a water-use minimization program is a reduction in all waste flows which lessens the practical, technical and economic burdens of acid waste treatment. The wastewater recycle program involved was, and continues to be, a success.

New emphasis was placed on the chemical treatment of mine waste flows from both active and abandoned operations. Several new acid waste treatment plants were installed by the mining industry. Also, all new mining operations coming into production are now subject to strict environmental controls. Major acid mine drainage problems should therefore not be experienced at any of the new operations.

## (ii) Stabilization of Tailings Piles

1968

There are a number of areas in the Province where pollution of water and nuisance conditions (wind-blown dust) have resulted. These problems occur primarily where industrial operations have resulted in large impounded areas of uncovered tailings or other waste solids. In many cases, the properties have been abandoned or the present owners cannot afford to effect the necessary improvements required. The old mining camps such as Cobalt and Timmins represent such a situation. Tailings which are exposed to the elements gradually erode away and move progressively from one location to another, sometimes through an entire watershed system, with harmful effects. Stabilization of these tailings piles by proper means is being encouraged by the Division and some work has been accomplished in this regard, notably The International Nickel Company of Canada, Limited in Sudbury and Hollinger Mines Limited in Timmins. However, much more needs to be done. All industry which create enormous piles of waste rock, or other materials such as gypsum from the fertilizer industry, should be made responsible for maintaining the site and for providing suitable rehabilitation after operations cease. Legislation and provisions for a security deposit to ensure that rehabilitation is carried out is being investigated at this time by an interdepartmental government committee in relation to the mining industry. It should be an accepted principle that no company should be permitted to abandon a site or operation which has the potential for causing future water pollution problems. The stabilization of mine tailings and other waste solids should be an integral part of all pollution control schemes from the inception of operations.

1971

As a result of recommendations and much work by the Division of Industrial Wastes, legislation was incorporated in 1970 into The Mining Act (Section 168-(1)) regarding the stabilization and rehabilitation of tailings areas. It is now the legal responsibility of the mine manager "to plant and maintain vegetation, or otherwise stabilize the tailings areas which will not be required for future impoundment of tailings to the satisfaction of the district engineer of mines". In addition, the amended legislation requires that "a bond or security deposit in an amount deemed necessary by the chief engineer of mines to complete the rehabilitation--shall be deposited with the Department of Mines". Thus, the stabilization and rehabilitation of tailings areas is now an integral part of a pollution control program by a new mine-mill complex from the start-up of operations.

While some revegetation has been successfully effected by The International Nickel Company of Canada, Limited in Sudbury and Hollinger Mines Limited at Timmins, problems of maintaining plant growth have been encountered wherever strongly acidic conditions exist. Several mining companies have observed effects similar to those encountered in arid areas where irrigation is extensively employed, namely, salts tend to migrate to the surface and kill the young plants. Mulching to reduce evaporation has extended the life of the plants, and underdraining to carry away concentrated solutions has been investigated.

In the gold mining and other areas where sulphides do not occur to any great extent, tailings dykes and piles are supporting the growth of both grasses and trees.

## (iii) Industrial Accidents and Spills

1968

Industrial accidents and spills of materials, whether deliberate or inadvertent, are of increasing concern. The potential for such spills in certain segments of industry is well recognized, however, little has been done by industry to safeguard against such emergency situations. In addition, there remains a reluctance on the part of industry to advise the Commission promptly of such accidents. Often, staff are informed of the details through some other source as, for example, the news media. Industry has been requested repeatedly to notify the OWRC of spills, especially where downstream water users are likely to be affected, so that appropriate response action can be mobilized.

Oil spills from refineries, steel mills, railroad yards and shipping have been the source of numerous complaints in the past. Fire hazards were created, fish flesh tainted, waterfowl endangered and recreational facilities damaged. A contingency plan is being developed to cope with major spills of oil and other hazardous materials in the Great Lakes basin. However, much has yet to be accomplished in minimizing the potential for accidental losses of materials from industries to watercourses. Precautions to deal with emergencies should be considered and appropriate options be engineered and built into waste treatment facilities, such as holding ponds. Continuing efforts should be made in the field of public relations by OWRC to convince industry that it is in its best interests to advise of accidents promptly.

Spills of hazardous materials to watercourses continue to be a significant pollution factor. Amendments to OWRC legislation in 1970 now make it mandatory for unusual discharges of materials to be reported forthwith to the Commission (Section 32-(3), R.S.O. 1970). Failure to do so can result in a $5,000 fine. Also, Section 34-(1), R.S.O. 1970 gives the Commission the power to order "any municipality or industrial or commercial enterprise to have on hand and available at all times such equipment, chemicals and other materials as the order specifies to alleviate the effects of any impairment of the quality of water that may be caused by the municipality or industrial or commercial enterprise". Failure to comply with the order can result in a fine of $500 maximum.

As a result of the new legislation, 285 spills were reported in 1971 to the OWRC, of which 19 were of major proportions. The loss of 600 tons of concentrated sulphuric acid to the Pickerel River due to a train derailment was one such accident. Causes of spills were due to a variety of factors including equipment failure, negligence on the part of operators and faulty maintenance. Sixty percent of all spills involved the loss of oil or other petroleum products. Only 17 percent of all spills could be classed as "true" accidents.

For a number of years, staff of the Division have been stressing the concept of prevention of spills to industrial officials and the philosophy is beginning to achieve results. Some companies have embarked upon Spill-Incident-Prevention programs and have forwarded formal reports to the Division for analysis. In general, it can be said that industry is much more aware of the potential for spills in processes and equipment, however, much needs to be done to improve this aspect of pollution control.

A major achievement in 1970 was the development and publication of the Interim Province of Ontario Contingency Plan for spills of oil and other hazardous materials. This Plan was designed to be compatible with the Federal and International Contingency Plans in the Great Lakes basin and with local co-operative contingency plans throughout the remainder of the Province.

A spill response centre, called the Ontario Operations Centre (OOC), has been established within the Ministry for the purpose of receiving spill reports on a 24-hour basis and initiating quick and effective response action. In the event a major spill is reported, the OOC would implement the Ontario Contingency Plan.

Under the Contingency Plan, Regional Operations Teams (ROTs) are being formed for the purpose of guiding the response to major spills within any given region in the Province. The ROT will serve as the "technical team on the scene" of any major spill which may affect watercourses.

In addition, the Canadian Chemical Producers Association and the Petroleum Association for Conservation of the Canadian Environment are developing contingency plans for dealing with moderate spills of hazardous materials and petroleum products during transport. It is hoped that this trend will continue and industry groups continue to develop local and area contingency plans for dealing with products manufactured by, or being transported for, them.

*(iv) Disposal of Concentrated Liquid Wastes*

*1968*

*The disposal of high-strength, low-volume liquid industrial wastes has primarily been on the land at selected sites. Lack of adequate legislation and regulations and improper operations at these landfill sites create major problems of water pollution from drainage and runoff. The recent amendment to the Public Health Act (later the Waste Management Act) will aid in the proper disposal of such wastes on 'approved' sites. However, the various types of concentrated wastes, particularly the non-combustible liquids which are generated by a complex diversity of chemical industries, require more sophisticated methods of disposal other than landfill for proper control. Further research into the treatment of such wastes and recovery of useful by-products are required. Also, in large urban and industrialized areas, the obvious approach appears to be centrally-operated facilities for the disposal of not only non-combustible liquid wastes, but combustible wastes such as oils and municipal refuse or garbage. In the meantime, the potential remains for pollution of surface and ground waters from these powerful chemical residues that are discarded by industry.*

1971

Little progress has been made in the area of disposal of concentrated liquid industrial wastes. Such wastes are still being disposed of in a number of selected landfill sites and by subsurface methods (wells) into the Detroit formation. As a result of regulations under the Waste Management Act (now the Environmental Protection Act), better control is exercised in the disposal of materials such as spent plating solutions, oily materials, waste acids and industrial cleaning solutions at landfill sites. However, the closure of one of the larger land disposal sites in the Metro Toronto area at Stouffville in 1970 precipitated a crisis which clearly showed the need for alternative and more sophisticated methods of disposal. It was suggested in the 1968 Status Report that central treatment facilities to handle complex industrial wastes were required. The Provincial Government has been trying to encourage private enterprise to build such a facility in Mississauga for over 2 years but up to the time of writing this report, despite much interest on the part of several companies, construction has not started.

In the meantime, great uncertainty prevails over the fate of the many complex and toxic chemical residues produced by industries in the metropolitan areas. It would appear that, since negotiations to date with private enterprise have failed to get concrete action, the government might well have to get into the business itself. Perhaps, this is not a desirable approach, however, the need for such facilities is obvious and a government-owned and operated utility providing a necessary service may not be all that out of line, particularly when it is considered that the government already offers associated services in the area of sewage treatment.

## *(v) Taste and Odour Producing Materials from Kraft Pulping Operations*

*1968*

*On rivers below pulp and paper mills in the Province which utilize the Kraft cooking process, the flesh of fish has been tainted adversely. Commercial catches have been rejected often in the market place and sports fishing also has been affected. Although the exact components responsible for the unpleasant tastes have not been identified positively, statistical evidence in Ontario shows that the tainting problem arises where untreated Kraft mill effluents are discharged to watercourses. Research is required to isolate and determine those compounds in the wastes which are responsible for the tainting and subsequently, removal or treatment of these materials is necessary to render them innocuous.*

1971

Research has been initiated into the origin of taste and odour producing materials and fish-flesh tainting potential from kraft pulping operations. Because of intense pressure brought to bear by staff, a study was undertaken by 'Domtar' at its Cornwall mill to identify the process waste streams responsible for taste, odour and fish-flesh tainting and to investigate methods for treatment of these noxious wastes. The study was subsequently funded by the Federal Government under the Water Pollution Abatement Research Program. Condensate waste streams from the digester and evaporator areas together with recovery furnace flue gas condensate were identified as the main contributors to odour and fish-flesh tainting.

There is good evidence to suggest that the treatment and disposal of these contaminants can be largely accomplished by in-plant methods rather than by facilities such as aerated lagoons which constitute the current practice for dealing with this particular pollution problem in North America. Segregation of condensates followed by stream stripping and incineration is being practised successfully at one installation in Sweden and Domtar is committed to installing a similar system at Cornwall in 1973. The success or failure of this system will determine the future approach to removing taste and odour compounds from Kraft mill wastes in Ontario.

*(vi) Control of Industrial Waste Discharges to Municipal Sewerage Systems*

*1968*

*Many municipalities which have signed agreements with the OWRC concerning the financing and operating of sewage treatment plants are failing to comply with the terms in the agreements with respect to control of industrial wastes discharging to the sewer systems. Enforcement of the terms of the agreements and, failing this, use of Section 62-(1)(f) and Section 70-(1) of the OWRC Act, R.S.O. 1970, is recommended. A procedure for enforcing the terms of agreements should be outlined and responsibilities within the Commission assigned.*

1971

The enactment and enforcement of sewer-use by-laws by municipalities to control the discharges of industrial wastes to sewer systems needs a better coordinated approach than is presently in existence.

In Ontario at present, there are 265 municipalities which have sewage treatment plants (STP). It is felt that at least 194 of these municipalities should enact a sewer-use by-law to regulate industrial discharges for treatment at the STP. One hundred and thirty-six municipalities have enacted some form of by-law and 66 of these have been requested by the OWRC to implement a by-law enforcement program but only 43 have done so. Currently, enforcement programs are being set up in an additional 21 municipalities. Thus, it is obvious that many municipalities can attract certain types of industry by neglecting to enact and enforce sewer-use by-laws to protect their sewage works, while at the same time settling for a poorer quality STP effluent to the local river or lake--in effect, creation of a so-called "pollution haven".

In addition, there are other problems associated with the control of industrial discharges to municipal sewerage systems. Municipalities which have signed agreements with the OWRC relating to financing and operating of sewage treatment plants have generally adopted a fairly uniform and consistent by-law in terms of allowable limits for specific pollutants. However, other municipalities have set higher or lower limits for varying reasons, some of them valid, and thus an industry may have to pretreat its wastes at considerable cost in one municipality to meet the by-law limits or else pay a surcharge fee, whereas the same type of plant in a neighbouring municipality may not have to bear these additional costs. For instance, industries in the plating and tanning business have recently complained at this apparent inequitable and inconsistent approach among municipalities and point to competitive disadvantages in this regard. Local elected representatives are concerned and would like to see such matters resolved.

It may be that legislation is required to have uniform sewer-use by-law limits placed on specific contaminants regardless of the municipality. This contentious matter requires greater attention and an imminent solution, otherwise, progress in this important aspect of pollution control can be slowed down. The question of the legality of special agreements between municipalities and industries should also be considered and resolved.

In 1969, a training course entitled "Control of Industrial Wastes in Municipalities" was started by the OWRC with the support of the City Engineers' Association. It was repeated in 1970 and 1971 and will continue to be given as long as there is a demand for it by those working in municipal control programs in Ontario.

## (vii) Location of New Industry

1968

Consideration of waste disposal practices continues to be a factor often overlooked or given low priority by industry establishing plants in new locations. Very often this oversight results in the selection of a poor site for a plant with respect to environmental pollution. In the case of mines and other resource-based industries, plant location is often restricted to few choices but this does not relieve the Company of its responsibility to provide adequate treatment and suitable ultimate disposal of effluents. Other industries should be located where treatment can be provided and adequate capacity is available in receiving waters to accept the treated wastes without unduly affecting other water uses.

Pollution control must be a factor taken into consideration by company management, along with all other relevant factors, when the decision to locate a new plant is to be made. Direct conflict of use of water can occur, as for example, when certain types of industry locate in drainage basins which are recreation oriented. The issue in question is not whether recreation is preferable to industrial development. With proper planning both uses of water can be compatible in the same basin. The salient fact is that existing (and potential) water uses of a drainage basin must be recognized and taken into account. Therefore, the OWRC must continue to work closely and improve liaison with other government departments and industry in offering advice on site suitability for new industry.

Mechanisms are being developed for assessing the potential impact on the environment at sites where new industry would like to locate. For example, for future thermal power generating stations, Ontario Hydro is now being requested to engage in environmental impact studies on proposed sites and to submit these studies for analysis by staff, many years in advance of committing the site for construction. In the period 1969-1970, when a major pulp and paper industry was considering the feasibility of building a new Kraft mill complex in the Haliburton region with discharge of treated wastes to the Madawaska River, it was clearly shown by Division staff that such a development would be entirely incompatible with the existing and future recreational uses of the region. As a result, the company proposed that the pulp mill be relocated on the shores of Lake Ontario with the debarking and chipping operations remaining at the centre of the wood resource near Bancroft. The project was finally abandoned but illustrated the type of analysis of sites for new industry being carried out in terms of the total potential environmental impact.

On another front, excellent liaison has been established with the Ontario Department of Trade and Industry. Whenever new industry plans to locate in Ontario, as a result of efforts by that Department, the OWRC is involved in the initial discussions with company personnel to offer advice and assistance on selection of potential new sites. Where it is appropriate, the suitability of industrial wastes for treatment at municipal sewage treatment plants is discussed, which often is a significant factor in final site selection.

Pre-operational baseline environmental studies are also being requested of major industrial complexes as a routine procedure, where concern for the effects on the aquatic environment exists. For example, such in-depth baseline studies are being done in northwestern Ontario in the Lake Shebandowan area by The International Nickel Company of Canada, Limited before the mine-mill complex comes into production. These studies generally continue upwards of two years and are to be continued long after the industrial operations are started. Similar studies are being done off Nanticoke in Lake Erie through a committee comprising of representatives from several government departments, Ontario Hydro, The Steel Company of Canada, Limited and Texaco Canada Limited.

An interdepartmental Task Force on Generation Station Siting has been formed with OWRC representation. One factor of concern is that public input is not solicited or assessed in the decision-making process. As controversial and time-consuming as it might appear, this public input appears to be necessary. This is becoming evident particularly in those instances where plants are being built under the regulatory and controlling auspices of the Federal authorities such as the Atomic Energy Control Board. Such installations include nuclear power plants and the Bruce Heavy Water Plant, and better mechanisms for site selections are required if major environmental use conflicts are to be avoided.

*(viii) Effluent and Water Quality Control Objectives*

*1968*

*The existing effluent and water quality control objectives of the Commission are not compatible with the rapidly changing and growing demands on the Province's water resources. These objectives and the management philosophy behind them were useful in the formative years of the OWRC in initiating a general program of pollution control. However, existing policy with respect to certain aspects of drainage basin management is inadequate and especially so in the field of pollution control. Thus, the regulatory functions of the Division of Industrial Wastes (and indeed that of the Division of Sanitary Engineering) are hampered. The development of new objectives and a more sophisticated approach to water management with respect to pollution control and water use are required.*

1971

In June 1970, the Water Quality Objectives Committee finalized its report "Guidelines and Criteria for Water Quality Management in Ontario" which was accepted by the Commission. The reports suggests a broad framework for drainage basin management of water resources, outlines policy guidelines for such management and lists criteria for a variety of water uses. Many of the concepts outlined in the report are being used by technical staff within the OWRC in river basin studies, however, the details of the framework have not been developed sufficiently and the mechanisms for implementing such aspects as water quality standards, public hearings and effluent requirements have not yet been formalized. The approach is still tentative, exploratory and of questionable legal status as for example, the matter of effluent permits. As a result, the concern expressed in 1968 still prevails in that drainage basin management of water resources in Ontario is not being effected in an optimized manner.

On another front, the technical expertise of staff and their experience in the practical aspects of industrial waste pollution control have been made available to the Federal Department of the Environment in the development of national regulations for broad industrial classifications. To date, considerable advice and help has been given in the pulp and paper, chlor-alkali, mining, fish processing and oil refining areas.

Because mining activities in Ontario have caused water pollution problems of major proportions, much time has been devoted to upgrading Provincial guidelines for waste control in that industry. These guidelines should be completed in 1972.

## (ix) Economic Considerations

1968

*In discussion with industrial officials and particularly with those of the pulp and paper industry, it is apparent that there is much concern about the high costs of waste treatment. It can be said that the economic constraint is the major reason why pollution control programs have not been implemented readily by certain segments of industry. The pulp and paper industry has gone on record to the Federal and Provincial Governments requesting financial incentives to ease the impending cost burden of pollution abatement measures. These incentives include tax reliefs, grants and low cost loans. Although the economic factor is a complex one indeed, it might not be out of line for the Commission to investigate means of encouraging and stimulating possible solutions to economic difficulties that certain industries are experiencing. The concept of government funds being used wisely to maintain existing industry as viable units of production should not be overlooked. Some of these existing plants are the economic cornerstones of many communities in Ontario. Already, precedent has been set in other fields whereby government aid in the form of forgiveable grants are given for expansion of old industries and also to new industries for locating in designated areas of the Province provided certain conditions are met.*

*The subject of benefit-cost analysis on a watershed basis from a water use and pollution control standpoint should be looked at more extensively by the OWRC in planning for the future. Although it may not always be easy or possible to place a monetary value on many of the intangibles in the field, such as the aesthetic enjoyment by the public of clean water, nevertheless, the economic benefits or losses to a community should be evaluated when the inevitable question arises regarding the reasons for implementing a waste control program.*

Financial incentives to industry to help in the battle against pollution have been instituted and are being considered further at both the Federal and Provincial levels of government. With the passage of the 'national' regulations for the pulp and paper industry by Ottawa and from experience with the costs required to "clean-up" the existing pollution on the Ottawa River, it is clear that unless financial aid is forthcoming, the national regulations cannot be strictly imposed without causing great social and financial hardships to the industries and communities alike.

The Division has worked extensively at preparing a financial brief exploring a number of alternatives but primarily on low-cost interest loans to industry. This report is being studied by the Provincial government. It is admittedly a short-term expedient to provide some impetus for continuing progress in pollution control through difficult economic times, recognizing that the ills of many industries including the pulp and paper industry are much more complex and fundamental which will require major decisions and changes (such as rationalization) if survival in Ontario and Eastern Canada is to be accomplished.

In 1970, the Ontario Development Corporation introduced a capital loan program for pollution control works for industry. The maximum amount of the loan, if ODC requirements are satisfied, is $250,000 which is really geared towards helping smaller industry with its pollution problems. The ODC loans are at current rates of interest (about 8 percent at the end of 1971), are not large enough for major treatment works and are not considered to be much of an incentive by industry. In 1971, Ontario also introduced a grant system for pollution control equipment which is in reality a rebate on the 5 percent Provincial sales tax. The straight-line capital depreciation over 2 years allowed by the Federal Government on treatment works is to expire at the end of 1972.

In summary, if some reasonable progress in pollution control is to be achieved in these inflationary times of high unemployment and apparently conflicting priorities for limited supplies of available capital funds, then it is believed that some direction and help will have to be given by governments to ease the social evil of environmental degradation. Punitive sanctions and the passing of even more stringent legislation will not provide the needed solutions to many problems.

## (x) Performance of Consultants, Equipment Suppliers and Contractors

1968

Still causing concern to staff is the poor follow-up service provided by some consultants and suppliers who have engineered or installed waste treatment equipment in various industries. Although this is a matter to be worked out between industries and their agents, long delays and inadequate waste control often result unnecessarily. If industry required performance guarantees, this problem could possibly be lessened. The Division, in an effort to eliminate the problem, now requires performance reports to be submitted on new treatment works shortly after they are placed in operation.

1971

The technical capability of consultants has improved over the past few years to deal with pollution problems, nevertheless, there is still considerable room for improvement. One major concept which needs to be more deeply engrained in industry and consultants is to do less thinking in terms of 'wastes' and to develop methods for the recovery, recycling and re-use of such wastes or their by-products in profitable ways. Too often is a consultant hired to design systems for treating wastes in a non-productive sense when fundamental changes in philosophy could reap better rewards.

The introduction of requiring guarantees on equipment performance by industry and the evaluation reports on new treatment works required by the Division have helped considerably in designers and suppliers specifying and providing the right type of waste treatment equipment.

## (xi) Nutrients

1968

The rapid fertilization of watercourses and especially of shallow lakes, is of increasing concern to the Commission. In Ontario, the appearance of abundant growths of algae and other aquatic plants is occurring in certain areas, admittedly more as a result of nutrients in domestic rather than in industrial wastes. However, in areas where fertilizer plants are producing nitrogen and phosphorus compounds, there are appreciable discharges of these materials to receiving watercourses. Applying the principle that nutrients can move through a watershed with subsequent deleterious effects far removed from the point of input, limitation of nutrients in industrial discharges is advocated by the Division. Limitations have already been placed on a number of high phosphate industrial discharges in Ontario. The minimization of nutrient losses from plants has been accomplished primarily by improved housekeeping and in-plant programs to conserve losses of raw materials and products. Treatment for the removal of nitrogenous materials in large quantities from industrial wastes does not appear to be economically feasible at this time and the philosophy exists that prevention is better than the cure. Removal of phosphorus, in the form of phosphate, is technologically possible but expensive for very small concentrations (1 to 2 ppm P) found in many large-volume industrial flows. In summary, there is no doubt that eutrophication of lakes is a potential problem from nutrient additions due to industrial waste discharges and this area of concern will continue to be looked at very carefully.

1971

Phosphorus in industrial discharges constitutes a very small percentage of the total loadings into Ontario's waters. All significant industrial sources have undertaken treatment programs. Reduction of nitrogenous wastes continue to pose problems, but at least one successful study in Ontario on nitrogen removal from wastes by biological methods has been completed. In-plant control and recovery of materials continue to be practised as the prime method for reducing nitrogenous compounds lost to watercourses. Based on available data, eutrophication of lakes in Ontario from phosphorus and nitrogen additions due to industrial discharges appear to be less of a problem than may have been postulated previously.

## (xii) Dissolved Hydrocarbons

1968

*In refinery and petrochemical complexes wherever hydrocarbons and other organic chemicals come into contact with water, appreciable quantities of these substances go into solution or are lost as wastes. As these compounds are difficult to detect by conventional testing procedures, many of them have been largely overlooked in the pollution control program. Much emphasis has been placed on phenolic compounds, almost to the exclusion of other dissolved hydrocarbons, because of taste and odour considerations. However, this subject is under study in the United States and to a limited degree in the OWRC. The toxic and other deleterious properties of hydrocarbons, such as benzene which is soluble to the extent of 800 ppm under normal conditions and which is relatively resistant to oxidation, should be investigated further. Most of the lighter boiling hydrocarbons discharged are probably released from water to the atmosphere resulting in few apparent pollution problems to date. However, with the expansion of the petroleum, petrochemical and synthetic organic chemical industries, it is important that the effects of these waste constituents be examined more closely.*

1971

Progress has been made in defining the types and quantities of dissolved hydrocarbons in discharges from some of the petroleum and chemical industries. One major study in the Sarnia area has been completed on the effects of petrochemical wastes in terms of bioassays, taste and odour measurements in water, and fish-flesh tainting. Where reductions of dissolved hydrocarbons in effluents have occurred, this has been achieved primarily by in-plant control practices. Much more research needs to be done to define the characteristics of dissolved hydrocarbons in specific waste streams, their effects on the aquatic environment and to develop suitable methods for removing and treating these materials. Further studies are planned by the OWRC with the cooperation of the oil refining industries.

## (xiii) Dissolved Salts

1968

The removal of dissolved salts from industrial discharges presents one of the greatest challenges in pollution control. In many cases where by-products can be recovered, markets are limited, as for example, the recovery of calcium chloride as a by-product from soda ash manufacture (for use on roads during the winter months) and the production of Vanillin from spent sulphite liquor. Many methods, such as reverse osmosis, are being developed to effect separation of the salts. However, the economics of most of these advanced methods of treatment are unattractive at this time, especially where large volumes are involved. Thus, the traditional approach has been to utilize the receiving watercourse to carry away the dissolved salts. However, pollution problems can be caused by such practices. The gradual build-up of dissolved solids in certain 'sinks', such as Lake Erie, is cause for concern. In northern Ontario, where many lakes are low in hardness content, the input of large quantities of dissolved salts from industrial discharges could have serious limnological effects. Scale and corrosion problems in equipment from water high in dissolved salts are becoming more frequent in areas of high concentration of industry. The consequences of creating an increasing saline environment in the Great Lakes system over an extended period of time merit study and is an area of concern.

1971

Reduction of high levels of dissolved solids in certain types of industrial discharges continues to be a challenge to industry and regulatory authorities. Limited markets for certain by-products such as calcium chloride and vanillin still prevail. Separation and concentration techniques such as reverse osmosis have been improved but such processes are only installed where the need is fully justified. In Lake Erie, the IJC has set a water quality objective of 200 ppm maximum for dissolved solids. The OWRC has worked steadily with those industries with high salt discharges, such as the soda ash manufacturers, on programs of recycle and minimization of in-plant material losses. In northern Ontario, re-use and recycling of mine water and treated mill process wastes from tailings areas have been strongly advocated by OWRC, wherever possible, and many mine-mill complexes have gone, or are going, to varying degrees of recycle.

In the interim, not much more can be done. However, in order to hold against increases in concentrations of dissolved solids in the Great Lakes system, some thoughts should be given on siting of those industries which are the chief contributors. Perhaps, expansions or new plants should not be permitted on the Great Lakes and particularly in the Lake Erie Drainage Basin.

## (xiv) Thermal Effects

1968

The increase in demand for electrical power has resulted in plans for construction of a number of new generating plants by Ontario Hydro. These installations, both nuclear and coal-fired, are being located on the lower Great Lakes system. The vast quantities of cooling water required by this industry and the resultant heat input to the receiving lakes have raised many questions about the potential effects on the aquatic environment. In an effort to arrive at some answers, Ontario Hydro and OWRC are working closely on water quality, biological and physical studies in the Nanticoke and Pickering areas on Lakes Erie and Ontario, respectively. The Department of Lands and Forests are also involved at Nanticoke because of the proximity of an active and valuable smallmouth bass fishery. It is expected that studies at these locations, including those at Douglas Point, will aid in predicting some of the thermal effects on the environment. These effects need not necessarily be all adverse, however, the lack of specific knowledge in this field which creates a problem for proper water resource planning is cause for concern to the OWRC, especially where potential conflict of uses is likely in areas designated for new generating stations.

1971

At the instigation of staff, much work has been accomplished in the last three years by Ontario Hydro on thermal studies at existing stations. The effects of heat on algae (cladophora) in terms of growth periods and abundance have been studied at the Lakeview Generating Station. Measurements have also been done on the thermal plume at this station which has led to the development of a crude mathematical model to predict the dispersion of the condenser cooling water plume at new sites. Baseline data on the aquatic environment continue to be collected and assessed at several locations such as Nanticoke, Lennox and Pickering. The Nanticoke Environment Committee was the first of its kind in Ontario and is an industry-government group studying many aspects of potential effects of future industrial activity, including heat losses, on a fishery. Guidelines for formal water quality studies have been drawn up by Hydro at the request of OWRC for new sites for thermal generating stations, primarily because thermal effects can still only be speculated upon. In summary, thermal effects on the aquatic environment from large heat sources such as Ontario Hydro are actively being studied and will be for very many years to come.

The following issues were not mentioned in the 1968 report but are included here as they are matters for concern which have been recognized in recent years.

## (xv) Subsurface Disposal

Subsurface disposal of wastes has come under increasing scrutiny in the past few years. This method of disposal is presently confined to the Detroit River geological formation in southwestern Ontario and is used by many chemical industries in the Sarnia area. However, evidence has suggested that disposal of wastes to this shallow formation is likely to cause problems in the future. The Government has developed a policy on the use of subsurface horizons for industrial waste disposal. Use of the Detroit formation is to be phased out and only the Cambrian will be considered in the future. Also, the types of wastes which can be pumped underground will be restricted in the future.

## (xvi) National Effluent Regulations

With the formation of the Federal Department of the Environment and the amendment to Section 33 of The Fisheries Act in 1970, Ottawa entered the pollution control field. National effluent standards are being developed and promulgated for certain select industry groups. Standards have already been promulgated for the chlor-alkali industry and the pulp and paper industry. Similar action is underway in the oil refining, mining and fish processing industries. Effluent standards for other industrial classifications will be developed in time.

Ontario has played a major role in advising its Federal counterparts on the effluent regulations. In the main, discussions at the technical level have been successful in resolving many differences. However, it should be pointed out that there are some fundamental differences of philosophy on which standards are being developed. Staff believe that 'poor' water management practices will result in some instances and therefore, certain regulations may be inappropriate in Ontario. Presuming that Section 33 of The Fisheries Act is to be administered in Ontario by the Ministry of the Environment, this might prove to be embarassing in that enforcement of the regulations may not be in the best interests of Ontario.

## (xvii) Mercury

In 1969, the OWRC discovered high concentrations of mercury in the bottom sediments of the St. Clair River below Dow Chemical of Canada, Limited. Investigations were started at Dow and at other chlor-alkali manufacturers in the Province to pinpoint the sources and magnitude of mercury losses to the aquatic environment. Analysis of effluents had only shown minor traces of this material in the past. That same year, programs were drawn up for reducing mercury losses at all plants and were put into action. However, when it was discovered in March 1970 that mercury levels in certain species of fish below the chlor-alkali plants were higher than the allowable limit (0.5 ppm) set by the Food and Drug Administration, the pollution reduction programs were accelerated by Orders of the Minister. Mercury losses from such plants fell rapidly to trace quantities and all plants at the end of 1971 were well within provincial and national regulations.

At the same time in March 1970, when it was discovered that mercury could be converted to methyl mercury by bacteria in the aquatic environment and then concentrated in fish, mercurial slimicides used in certain pulp and paper mills were banned from use. Other industrial areas where mercury was used were investigated and appropriate controls installed to prevent losses to the environment.

Concern remains because of the large quantities of mercury lost over the years to certain major rivers such as the St. Clair and the Wabigoon River-English River system. This material is in the bottom sediments and will be released over a long period of time. Studies into feasible and economic ways of de-activating or removing the mercury are still continuing.

## (xviii) Chlorinated Aromatic Hydrocarbons

Chlorinated aromatics are of major concern to all who are aware of the disastrous effects that some of these compounds can have on fish and wildlife. DDT is such an example. In recent years, polychlorinated biphenyls (PCBs) have been discovered in significant quantities in some fish in many parts of the world, including here in Ontario. The potential adverse effects of PCBs on wildlife and aquatic biota are not clearly defined, but studies have shown that some of these effects are not unlike those produced by DDT.

An intensive survey has been done into the uses and losses of PCBs from industrial sources in Ontario. Investigations have failed to identify any significant direct inputs of PCBs into the aquatic environment. It is believed that PCBs are gaining entry to rivers and lakes via other pathways and are finally ending up in the fish, reflected by the concentrations that are being found.

Until recently, the major proportion of annual PCB usage (35,000 pounds) in Ontario was for incorporation into sealants, caulkings and as a plasticizer in plastics formulations. These uses represented "open-ended" systems with a great potential for PCB input to the environment. Consequently, the Monsanto Company, the only North American manufacturer, withdrew from the market those compounds used for these applications. In so-called "closed systems", a reclamation service is offered to users of PCB-type transformer fluids and heat transfer media.

Because of the large bio-magnification factor and their extreme stability in the environment, studies are continuing in Ontario to determine the 'secondary' sources of PCBs to the environment.

## (xix) Metals

Increasing attention has been paid to metals since the mercury problem arose in Ontario. Studies have been conducted on the quantities of metals discharged to municipal sewer systems by industries and which are discharged in the treated effluents to watercourses, or end up in the waste sludge at the STP for disposal elsewhere. Some concern exists in applying sewage treatment plant sludges on agricultural land, for high concentrations of metals have been found in sludges from certain municipalities which have a number of metal plating and finishing operations. In base mining operations in the Province, chemical treatment for precipitation of metals is being pursued actively. Studies into cadmium, a metal considered to be as toxic as mercury, have shown no significant industrial discharges. In the Sudbury area, work is being done to assess the significance of airborne fall-out of metals into receiving rivers and lakes from smelters in the area. The fall-out of metals is also associated with other contaminants, one of the apparent effects being a drop in pH values of nearby lakes. Altogether, work is progressing on many fronts on the levels of metals such as copper, chromium, zinc and lead in receiving waters.

## (xx) Specialty Chemicals

Specialty chemicals are used by industry for specific purposes such as corrosion control, boiler feed water treatment, foam depressants and slimicides.

Since 1970 when the bio-magnification effects in fish of small amounts of mercurial slimicides used by the pulp and paper industry was discovered, greater attention has been focussed on the types of specialty chemicals being marketed for use in Ontario in terms of their potential impact on the aquatic environment.

Toxicity and other pertinent data have been assembled on mine-mill reagents. Also, data are being accumulated on the nature, usage and potential environmental effects of chemicals used in the pulp and paper industry, for those chemicals proposed as oil spill treating agents and for chemicals used in water treatment and conditioning.

It is hoped that this information will provide a factual basis for considering the usage of various classes of specialty chemicals in terms of their environmental effects.

FUTURE ACTION

*NOTE: The courses of action suggested below are broadly stated as potential avenues for dealing with some of the problems mentioned in this status report. It must be recognized that official policy has not been defined on some of these issues.*

(1) Economic Incentives to Industry

This matter is now under review by the Resources Policy Field Committee. It would appear that, unless the economic climate changes, further progress in pollution control in certain important industrial classifications such as the pulp and paper industry will be seriously impeded. Therefore, financial incentives to industry from governments might help to maintain the existing impetus in pollution control.

(2) Drainage Basin Management

Formal mechanisms for implementing drainage basin management of water resources in Ontario are required in order to optimize water usage in specific basins and to aid in resolving many attendant issues such as the setting of water quality and effluent standards.

(3) Municipal Control of Industrial Discharges

Further efforts must be directed towards reducing the problems apparent in this area, probably through legislative means. When it is estimated that 60 percent of municipal flows are industrial in origin, the importance of this matter is more easily understood.

(4) Siting of Major Industrial Complexes

Where significant or important industrial development is proposed, environmental impact statements should be required to form a basis for overall government approval or rejection of such proposals.

(5) Contingency Planning

Efforts should continue in creating regional operations teams. Communications and procedures must be improved at the provincial, national and international levels for it is becoming apparent that, through better coordination, considerable cost savings can accrue to the individual parties having a legislative or vested interest in the development and operation of such plans.

(6) Legislative Amendments

The development of effluent regulations for the industrial pollution control program, the inclusion in the Environmental Protection Act of sections relating to mandatory monitoring of effluents and reporting of data, and provision for implementation of an effluent permit program in the Province should be further investigated.

(7) Research

More research into the technical problems listed in this report is required. The use of Federal facilities and funds should be actively explored.

(8) Information Systems

The development and implementation of an automated data processing system is required to upgrade many administrative functions of the industrial pollution control program.